chapter one

AN INTRODUCTION TO SALT MARSH MONITORING

Salt marshes are beautiful coastal landscapes that provide rich **habitat** to a great **diversity** of plants, **invertebrates**, fish, birds, and mammals. For many people, the opportunity to see snowy egrets stalking fish, or fiddler crabs scurrying across the marsh is reason enough to be concerned about salt marsh health. Salt marshes are extremely important for a variety of reasons besides their beauty or the biological diversity they support. Salt marshes serve as nursery grounds for many economically important fish and shellfish such as crabs, mussels, and clams, and they help fuel **food webs** by recycling and exporting tremendous amounts of nutrients. Salt marshes protect shorelines from storm damage by dispersing wave and tide energy, and help purify water by assimilating potential pollutants.

Over the last three centuries, vast areas of salt marshes have been ditched, drained, and filled because humans perceived them as barren unproductive areas with little economic importance. Direct **wetland** filling, point source pollution, nonpoint source pollution, and restriction of tide flow by road and railroad crossings have all taken a heavy toll on New England coastal salt marshes. In 1969, John and Mildred Teal published their book *Life and Death of the Salt Marsh,* which highlighted the beauty, importance, and plight of these precious ecosystems. This book helped foster public appreciation for salt marshes and launched the next three decades of salt marsh conservation.

Scientists and managers have developed a variety of tools to assess salt marsh health. Aerial photography and Geographic Information System (GIS) technology are used to determine wetland quantity by comparing recent versus historical maps and photographs, and to document changes that result from coastal development (i.e. houses, roads, etc.). However, wetland quality usually needs to be assessed by field measurements of biological, physical, and chemical **parameters**. Regulations help prevent further filling and fragmentation of wetlands, but they alone are not sufficient to adequately protect these habitats. Scientists are currently developing and employing tools to detect **biological impairment** in these habitats. Eventually, the information generated from these assessments will help to improve regulatory and other protection efforts.

A growing number of citizen and volunteer organizations are becoming involved in conservation programs aimed at restoring or protecting salt marshes. Many local citizens under the guidance of nonprofit volunteer organizations are collecting field data to document the condition of salt marshes and look for evidence of habitat degradation and biological impairment. Scientists refer to this effort as **monitoring**, which is the unbiased collection and precise recording of data over time. This publication advocates an integrated approach to monitoring that combines biological, physical, and chemical measurements; this approach provides a comprehensive and ecologically sound overview of salt marsh condition. Volunteer monitors provide a valuable service to their communities, to scientists who are trying to develop a better understanding of salt marshes with diagnostic **indicators** of wetland condition, and to managers who are trying to implement restoration projects and conservation plans to protect salt marshes.

CZM staff and volunteers conducting invertebrate monitoring. **Photo: Ethan Nedeau**

GOALS OF THIS MANUAL

This manual was developed by the Massachusetts Office of Coastal Zone Management (CZM), Massachusetts Bays Program (MBP), and several partners (see textbox on page 1-3) as a tool to help local volunteer groups collect and record data on salt marsh health in a consistent and scientifically sound manner. The goals of this manual are to:

- Encourage education and promote knowledge of salt marsh ecology.
- Promote stewardship of salt marshes, particularly in restoration and protection.
- Expand the number of qualified individuals who can help scientists learn more about the condition of the region's marshes.
- Generate quality data to be used in the assessment of the health of a marsh and in restoration or protection efforts.

RECENT SALT MARSH MONITORING IN NEW ENGLAND

The rationale and protocols contained in this manual are the culmination of nearly seven years of collaborative effort among the authors, other wetland scientists in the Northeast, and several state and federal agencies. These efforts focused on developing salt marsh bioassessment techniques, which are used to measure wetland health by examining resident plants, animals, and their habitat. While there has been decades worth of research and examination into salt marsh biology and processes, bioassessment of New England salt marshes was just beginning in 1995 when the authors of this manual began to develop scientific monitoring protocols in a series of pilot projects. Through these projects, the authors were able to develop, test, evaluate, and revise the sampling and analysis techniques for different biological, physical, and chemical parameters to examine how they reflected wetland condition. The goal was to first build a knowledge base for salt marsh monitoring, and then transfer this information to volunteer monitors via training workshops and a published manual.

PARTNERS AND ROLES

Massachusetts Bays Program (MBP): MBP is one of 28 National Estuary Programs around the country. It has been the principal coordinator for the salt marsh volunteer training program and has coordinated the funding and development of this manual.

Massachusetts Office of Coastal Zone Management (CZM): This is a state program that is funded by the National Oceanic and Atmospheric Administration. CZM initiated research to develop a framework for assessing wetland condition and adapt these procedures for volunteer monitoring, and has played a key role in training volunteer monitors. In addition, CZM has contributed significantly to the development of this training manual.

Salem Sound 2000: This is a small non-profit organization, and through a partnership with MBP, helps coordinate and assist volunteer monitoring groups with fieldwork. In addition, Salem Sound 2000 has contributed to the development of several chapters of this training manual.

U.S. Environmental Protection Agency (US EPA): This federal organization provides base program funding to MBP through its Office of Water. In addition, US EPA has provided specific funding for the development of the salt marsh volunteer training program and the production of this training manual.

National Oceanic and Atmospheric Administration (NOAA): This federal organization provides funding for CZM and provided the initial funding for the salt marsh research. NOAA has continued to support CZM staff for all phases of this project, including the development of the training manual.

Anna Hicks: In her capacity as staff for the University of Massachusetts Cooperative Extension and as an independent consultant, Anna Hicks has contributed to the research and development of the volunteer training program and this training manual, particularly the sections on macroinvertebrates.

Salt marsh monitoring in the Northeast took several steps forward in 1999 when the Global Programme of Action Coalition for the Gulf of Maine (GPAC) held a workshop for resource managers and scientists to discuss standard protocols for salt marsh inventories and monitoring procedures. Participants were able to review, evaluate, discuss, and finally recommend regional standards for salt marsh monitoring protocols. Regional standards were then published in a workshop report entitled *Regional Standards to Identify and Evaluate Tidal Restoration in the Gulf of Maine* (Neckles and Dionne 1999). The approach and methods contained in this manual are consistent with those outlined in the GPAC report.

In 1997, the U.S. Environmental Protection Agency (US EPA) declared wetland monitoring a national priority and convened a national Biological Assessment of Wetlands Workgroup (BAWWG). In this workgroup, wetland scientists from federal and state agencies and universities collaborated to improve methods to evaluate the **biological integrity** of wetlands. A New England chapter of BAWWG was established in 1998 and has facilitated further development of techniques and methods for surveying or monitoring salt marshes.

In 1999, CZM, MBP, and Salem Sound 2000 began offering workshops to teach prospective volunteers how to monitor salt marshes. These workshops developed into the Wetlands Health Assessment Toolbox (WHAT) program. This program used a compilation of written guidance materials, workshops, and other technical assistance to provide volunteers and volunteer trainers with methods and practical advice to evaluate salt marshes in a way that is consistent, repeatable, and of maximum benefit to agency scientists and resource managers. This manual is the culmination of three years worth of development and refinement of training methods.

Salt marsh habitat. **Photo: Ethan Nedeau**

THE ROLE OF VOLUNTEER MONITORS

Some people may view the development of a volunteer monitoring project as a daunting task and ask questions such as, "What can I do?" "How can I help?" and "What will my contribution mean?" Volunteer monitoring is very important because it provides much-needed data to scientists and resource managers. You do not need a college degree in biology to be a volunteer monitor — all you need is enthusiasm and a willingness to learn.

Why Volunteer Monitoring Is Important

Coastal resource managers need better information about the condition of salt marshes and their potential threats to more effectively develop and implement protection and restoration strategies. In New England, significant momentum in the identification and inventory of salt marsh tide restrictions has given rise to numerous restoration projects. In addition, cities and towns, watershed organizations, and state agencies are actively working to address the adverse effects of stormwater pollution to wetlands and waters. Efficient use of resources is needed to accurately evaluate the impacts to salt marsh ecology, the feasibility of proposed mitigation projects, and the effects of restoration actions.

Volunteer monitors can play a pivotal role by providing resource managers with much needed field data. Volunteers, resource managers, and scientists all benefit from this type of partnership. Volunteer monitors receive training in wetland science and assessment and become active in local resource planning and decision-making. Agency scientists can monitor more projects and gather more data than would have otherwise been possible, and this can help them develop effective ways to protect or restore salt marshes. Volunteer groups should coordinate with state and regional groups to learn how and where monitoring efforts are needed.

The Role of Volunteer Data

Volunteer participation in government monitoring programs is not a new phenomenon. For many decades volunteers have been counting birds, taking Secchi disc readings in lakes, listening for breeding amphibians, and collecting stream invertebrates to provide valuable data to state and federal agencies. Counts, surveys, and simple tests are well

suited for volunteers that do not have the scientific training or the time to devote to large-scale research projects. Historically, agencies were hesitant to encourage or train volunteers to undertake large-scale research projects for a number of reasons:

- Agencies lacked guidelines for study design and data collection particularly suited for volunteers.
- Agencies lacked resources to train volunteers.
- Agencies were concerned about the ability of volunteers to collect scientifically and legally defensible data that could directly influence conservation and management decisions.

Walking through salt marshes can be challenging! **Photo: Vivian Kooken**

MBP and CZM have invested a lot of time and resources to train volunteers to conduct salt marsh research so that volunteers can collect data that are as rigorous and defensible as data collected by staff scientists. The guidelines and procedures outlined in this manual and taught at workshops are not mere suggestions — volunteers need to follow these guidelines to ensure data quality. Using this manual, volunteers can gather data that may directly influence the conservation and management of coastal resources.

Level of Technical Expertise

Volunteer monitoring requires only an interest in salt marshes and a willingness to devote time and energy toward their conservation. However, the use of technical language and terms of research methodology is unavoidable in this publication because you are being trained to think like a scientist and conduct careful monitoring. The authors of this manual have tried hard to find a suitable balance between user-friendliness and scientific rigor. The methods and techniques described are specifically designed for people who may not have direct training or education in salt marsh ecology or monitoring, yet are willing to learn techniques necessary for gathering important and credible information.

PRACTICAL ADVICE AND CONSIDERATIONS FOR VOLUNTEER MONITORS

Volunteers following the methods outlined in this manual will be walking and wading in salt marshes. This can be an enjoyable experience, but volunteers should take steps to protect themselves and the salt marsh from harm.

Safety Issues

Salt marshes can be dangerous places, or at the very least difficult to walk through. Volunteers must be prepared for all types of conditions. Scorching sun, biting flies, ticks, poison ivy, thick mud, and potholes can combine to make an uncomfortable experience for unprepared volunteers. Do not work alone! It is important that volunteers be accompanied by at least one other team member when entering a marsh. Marshes are often intersected by ditches or dotted with potholes that are usually concealed by dense vegetation. Step carefully!

Estuarine streams and tidal flats are renowned for deep thick mud, and when you are stuck knee deep as the tide rolls in there is nothing more welcomed than a helping hand from a fellow crewmember. Mudflats also have a large appetite for loose-fitting shoes! It is easier to sink your foot into deep mud than it is to pull your foot out, and oftentimes shoes are lost if they are not laced tightly.

Poison ivy is very common in the high marsh-upland transition zone, and it is important that sensitive individuals wear long clothing to protect themselves. In addition, ticks and biting flies can be both a nuisance and serious health threat, since deer ticks may carry Lyme disease. Long clothing and insect repellent are good deterrents, and volunteers should thoroughly check themselves for ticks after leaving a wetland.

ESSENTIAL FIELD EQUIPMENT

Volunteers should always bring the following items when entering a marsh to ensure that they will be comfortable and safe:

- Sunglasses
- Sunscreen
- Wide brim hat
- Water to drink
- First aid kit
- Insect repellent
- Appropriate clothing & footwear
- Cell phone (in case of emergency)

Humidity in salt marshes can reach uncomfortable levels because of evaporation from saturated soils and transpiration from vegetation. The marsh can get very hot because there is no shade, and the warmth is exacerbated by high humidity. In addition, light intensity is high because there is no shade and the marsh and surface water reflect sunlight. Sunscreen, sunhats, sunglasses, and water to drink will be among the most important items you will bring to the marsh. Volunteers may consider carrying waders and extra clothing so they do not overheat when walking to or returning from the sampling sites.

Care of the Salt Marsh

Salt marshes are fragile and sensitive ecosystems. Most types of monitoring require that volunteers enter the marsh, and they should be mindful of how their activities affect the marsh and take appropriate steps to minimize impacts. Vegetation trampling and substrate erosion are big concerns. Volunteers should minimize unnecessary trampling and follow paths at sites that they visit repeatedly. When entering estuarine streams and crossing ditches, select areas of bank that aren't too high or too steep; clambering up and down steep streambanks will quickly result in bank erosion.

Wildlife disturbance can be a concern at some locations. Birds may breed or nest in the salt marsh, marsh border, or adjacent dune areas. If possible, identify important breeding territories and avoid these sites during the nesting season. **Invasive species**, such as *Phragmites australis* (common reed), have become a huge problem in coastal wetlands. Most invasive plants have excellent dispersal abilities and rely on animals (or people) to transport them to new sites. You can help curtail the spread of invasive species and pathogens by thoroughly washing waders, footwear, and sampling equipment immediately after leaving one marsh and before moving to another. If you cannot make it to a hose, wash right there in the creek, pond, or bay at the site you just finished.

Naming Conventions for Plants and Animals

This manual uses both common English names and scientific Latin names. Different fields of study have different protocols for naming species. Plant and invertebrate specialists mostly use scientific names, while bird and fish specialists mostly use common names. This manual will use the most widely accepted types of names for each biological group.

A Word About Software

The "Data Entry" and "Data Analysis and Comparison" sections of this manual assume that volunteers and project leaders are familiar with spreadsheet software. Spreadsheets are especially useful for tabulating, sorting, and summarizing data. While many software products exist, the authors of this manual recommend Microsoft Excel because it is present on virtually all personal computers. Project leaders may also want to employ database software in their monitoring program, such as Microsoft Access. Database software is useful for storing large amounts of site-specific data (including digital photographs), querying the data, and generating lists and reports. Used together, database and spreadsheet software provide excellent means to store, manage, and analyze data.

REFERENCES

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